

## REMARKS

The above amendments to Claims 1 and 11 serve to more clearly and precisely define the invention presently being claimed. In particular, the point at which the alcohol is added in the process of Claims 1 and 11 has been clarified, and the total amount of base added for the neutralization has been further defined. Claims 1 and 11 have also been amended to clarify that the neutralized reaction mixture is phase separated to form an organic phase which contains the polyamines of the diphenylmethane series. Support for these amendments can be found in the present specification on page 7, lines 5-17; page 7, line 31 through page 8, line 2; and page 8, lines 12-21. Original Claims 2, 6 and 7 also provide support for the amendments to Claim 1, and original Claims 12, 16 and 17 provide additional support for the amendments to Claim 11.

The amendments to original Claims 8 and 18 also serve to further clarify this aspect of Applicants' invention. Claims 8 and 18 are now independent claims. Accordingly, the necessary details from Claims 1 and 11 have been incorporated into presently amended Claims 8 and 18. These amendments serve to further clarify that the first phase separation, step c) therein, forms an organic phase and an aqueous phase. In addition, by the present amendments, the processes of Claims 8 and 18 require a second phase separation after the addition of the alcohol and the additional quantity of base. The addition of alcohol in Claims 8 and 18 occurs after the first phase separation, with the alcohol being added to the organic phase along with the additional base. The amount of base used in the second addition has also been defined. Support for the amendments to Claims 8 and 18 is found in original Claims 1 and 11, respectively, as well as in the original specification on page 6, lines 20-22; page 8, line 31 through page 9, line 1; and page 9, lines 14-15.

New Claims 21 and 22 are dependent on Claim 8 and are supported by original Claims 9 and 10. New Claims 23 and 24 are dependent on Claim 18 and are supported by original Claims 19 and 20.

The amendment to Claim 9 is editorial in nature and serves to delete the term "the" before the phrase "said base".

The present amendment also serves to cancel original Claims 2-7 and Claims 12-17.

Applicants respectfully submit that the preceding amendments are fully supported by the original specification. No new matter has been added by these amendments.

Claims 11-20 were rejected under 35 U.S.C. 112, first paragraph as failing to comply with the enablement requirement. The present claims are said to contain subject matter which was not described in the specification in such a way as to enable one of ordinary skill in the art to which it pertains, or with which it is most nearly connected, to make and/or the invention.

In this regard, the Examiner stated that the "process of Claims 11-20 allows for the polyisocyanate product to be in the presence of the alcohol; however, Applicants have failed to teach how to prevent reaction between the alcohol and isocyanate groups.

It is respectfully submitted that this rejection is moot in view of the preceding amendments to Claims 11 and 18. The above amendment to Claim 11 clarifies that any alcohol (including methanol) is removed from the organic phase which contains the polyamines of the diphenylmethane series by phase separation. Phase separation of the neutralized reaction mixture results in an organic phase which contains the polyamines and an aqueous phase which contains the alcohol. Thus, both Claims 11 and 18 clarify that the alcohol in the aqueous phase is separated from the polyamines in the organic phase. This is true for all embodiments of the present invention, regardless of when the alcohol is added in the process. Therefore, in accordance with the present claims, alcohol is not present during the formation of the polyisocyanates or after the polyisocyanates are formed. Thus, there is no possibility of the alcohol reacting with the isocyanate groups of the resultant polyisocyanates. Applicants therefore submit that this rejection is moot and respectfully request that it be withdrawn.

Claims 8 and 18 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

This rejection is moot in view of the preceding amendments to Claims 8 and 18.

Claims 1-5, 9, 11-15 and 19 were rejected under 35 U.S.C. 102(b) as being anticipated by WO 99/40059.

The WO 99/40059, the Strofer et al reference is believed to correspond to U.S. Patent 6,433,219. This reference discloses a process for preparing methylenedianiline (i.e. MDA) by reacting aniline with formaldehyde in the presence of acid catalysts which minimize the unwanted by-product N-methyl-MDA. The reaction mixture comprising MDA is worked up by neutralization, phase separation, distillation and/or chromatographic separation. Neutralization is preferred. The neutralization preferably uses a sodium hydroxide solution. Higher molecular weight addition products such as poly(oxymethylene)glycols may be in equilibrium with the formaldehyde used as a starting component.

The Examiner has stated that "the recitation of the poly(oxymethylene)-glycol component meets applicants' claimed alcohol component". See page 3 of the Office Action dated December 14, 2004, section 4, 2<sup>nd</sup> paragraph, lines 6-7 therein.

Applicants respectfully submit that the poly(oxymethylene)glycols of the Strofer et al reference are added as part of the formaldehyde reaction component therein instead of the entire amount of formaldehyde which would normally be used. This is apparent in light of the description which states that "... the formaldehyde being able to be in equilibrium with higher molecular weight addition products such as poly(oxymethylene)glycols" (column 3, lines 32-34). Obviously, these poly(oxymethylene) glycols are polymeric forms of the formaldehyde component. It is clear from this that the poly(oxymethylene)glycols are present during the condensation reaction between the formaldehyde and aniline. Thus, these poly(oxymethylene)glycols are no longer present in the reaction mixture at the end of the condensation reaction. Accordingly, even if

they are "similar" to the presently required alcohol component, they are not present during the neutralization as required by the present claimed language.

By comparison, the alcohol component in the present invention is added at a point after completion of the condensation reaction between the formaldehyde and aniline components. This is readily apparent from the present language of Claims 1 and 11. The present claim language clearly allows the alcohol to be added (1) at the beginning of the neutralization step, (2) during the neutralization step, or (3) after completion of the neutralization step and before the phase separation, i.e. step c). Obviously, the point of addition of the alcohol component in the present invention is **after** the condensation reaction between the formaldehyde and aniline is completed.

The Strofer et al reference does not disclose or suggest that an alcohol be added to the process therein at some point **after** the condensation reaction between the formaldehyde and aniline is completed. This is clearly required by the presently claimed process as described above.

It is also submitted by Applicants that the poly(oxymethylene)glycols of the Strofer et al reference are essentially the same as the polyoxymethylene glycol identified in the present specification as a suitable component to be used instead of (or in addition to) formaldehyde to supply methylene groups to the condensation reaction. The Examiner's attention is directed to page 5, lines 1-4 of the present specification. If and/or when these polyoxymethylene glycols are present in the condensation reaction of the present invention, they are no longer present once the condensation reaction is complete.

Although the polyoxymethylene glycol disclosed at page 5, lines 1-4 of the present specification is identical to that of the Strofer et al reference, this is **not used instead of** the alcohol component in the present invention as discussed hereinabove. Rather, the presently claimed process could contain both a polyoxymethylene glycol in the condensation reaction, and an alcohol component in or after the neutralization step. However, the present claim language clearly requires the presence of the alcohol component in or immediately after the neutralization! The polyoxymethylene glycol in the

condensation reaction, as described by the Strofer et al reference is optional in the present invention.

In addition, the present invention requires that a stoichiometric excess of base be added in the neutralization step of the claimed process. See step b) in each of Claims 1 and 11. The Strofer et al reference does not disclose any information relative to the quantity of base added in the neutralization step of the process therein. Rather, it only broadly discloses neutralization with, for example, sodium hydroxide. See column 3, lines 20-23 and Comparative Example 1 at column 9, lines 27-28. Therefore, Applicants respectfully submit that this reference does not disclose or suggest using a stoichiometric excess of base to neutralize the condensation reaction product. An excess is, however, clearly required by the present claim language. Accordingly, it is respectfully submitted that the Strofer et al reference does not anticipate the presently claimed invention.

In view of the above, Applicants submit that there are at least two differences between the Strofer et al reference and the presently claimed invention. Accordingly, this reference does not disclose the presently claimed invention with the specificity of an anticipatory reference. Therefore, Applicants respectfully submit that the presently claimed invention is not anticipated by this reference, and request that this rejection be withdrawn.

Claims 1-5, 9-15, 19 and 20 were rejected under 35 U.S.C. 102(b) as being anticipated by the Ross et al reference (U.S. Patent 3,478,099).

The Ross et al reference also discloses a process for the production of methylene diamines. This process comprises the condensation reaction of an aldehyde such as formaldehyde, and an aromatic primary amine such as aniline, to form primary aromatic amine compounds. Specifically, the process comprises first mixing or blending aniline with an aqueous strong mineral acid (preferably hydrochloric acid) in a sufficient amount such that it reacts with at least a portion of the aniline to form aniline hydrochloride. This aniline-acid mixture is then mixed with the aldehyde (e.g. formaldehyde) in a manner to

ensure thorough intermixing and contact between the various ingredients. (See column 2, line 51 through column 3, line 27; and column 4, lines 30-36.)

It is expressly disclosed in the Ross et al reference that the formaldehyde reacted with the aniline to form the primary aromatic amine compounds is generally present in the form of formalin. Formalin is a solution of methanol, water and formaldehyde (see column 5, lines 60-61; and column 6, lines 39-43). It also expressly stated that it is preferred to use formaldehyde which is free of methanol for greater ease of operation (see column 6, lines 42-43). Applicants respectfully submit that when methanol is present due to formalin being used as the reactant instead of formaldehyde in the condensation with aniline in the first step of the process of this reference, this methanol is no longer present in the reaction mixture at the end of the condensation reaction.

The presence of methanol in the condensation reaction between aniline and the aldehyde (i.e. formalin) requires careful control of the temperature to be constant at a level below the temperature at which methanol boils (i.e. about 64-65°C). (See column 5, lines 54-62.) However, pressure buildups as the temperature approaches the boiling point of methanol.

Applicants respectfully submit that the presence of methanol during the condensation reaction between aniline and an aldehyde (i.e. formaldehyde) is different than the addition of an alcohol as required by the present claim language. It is evident from Applicants' claims that an alcohol must be added (1) at the beginning of the neutralization step, (2) during the neutralization step, or (3) after completion of the neutralization step and before the phase separation step. Therefore, it is readily apparent the point of addition of the alcohol component in the present invention is **after** the condensation reaction between the formaldehyde and aniline is completed.

By comparison, the Ross et al reference clearly requires methanol to be present **during** the condensation reaction. This is self-evident in the fact that methanol is only disclosed as being present when the formaldehyde component is present in the form of formalin. As previously discussed, formalin comprises a solution of methanol, water and formaldehyde (column 5, lines 60-62 and

column 6, lines 38-42). Applicants therefore submit that the presently claimed invention is not anticipated by the Ross et al reference.

In addition, the neutralization step disclosed by this reference only broadly describes adding sodium hydroxide to the condensation reaction mixture such that it forms sodium chloride by reacting with the hydrochloric acid (column 6, lines 9-18). As previously discussed, the presently claimed invention requires a stoichiometric excess of a base for the neutralization (see step b) of Claims 1 and 11). Applicants therefore submit that the Ross et al reference does not describe the present invention with the specificity of an anticipatory reference.

In view of the above remarks, it is submitted by Applicants that the Ross et al reference does not anticipate the presently claimed invention. It is therefore submitted that this rejection is improper and requested that it be withdrawn.

Claims 1, 2, 6, 7, 9-12, 16, 17, 19 and 20 were rejected under 35 U.S.C. 102(b) as being anticipated by the Adkins et al reference (U.S. Patent 5,312,971).

The Adkins et al reference discloses a process for the production of polymethylene polyphenyl polyisocyanates. This process comprises reacting aniline and formaldehyde in the presence of an acid catalyst (e.g. aqueous hydrochloric acid) to yield polyamines of the diphenylmethane series. These polyamines are isolated from the reaction mixture by adding a neutralizing agent, generally sodium hydroxide, and then removing any excess neutralizing agent, water and aniline. These polyamines are phosgenated to yield the corresponding polyisocyanates. Also, the process requires the addition of a reducing agent (to reduce the color of the corresponding polyisocyanates) at any point following the addition of the neutralizing agent and before the stripping of the solvent used for phosgenation. (See column 1, lines 46-62.)

Suitable reducing agents are disclosed at column 2, lines 3-13 of the Adkins et al reference. These include boron hydrides, boron halides, metal hydrides, alkali metal alkoxides and hindered phenols. It is also disclosed at column 2, lines 22-33 that it may be necessary to quench the mixture when a

highly reactive reducing agent is used in the process. Suitable components for quenching include low molecular weight monoalcohols, preferably methanol.

Applicants respectfully submit that it is evident from the express disclosure of this reference that the low molecular weight monoalcohols including methanol are **not** described or suggested as improving or decreasing the color of the resulting polyamines or polyisocyanates. Rather, the Adkins et al reference clearly discloses that the reducing agents are effective in reducing the color of the corresponding polyisocyanates (see column 1, lines 54-56). This reference does not disclose or suggest that the low molecular weight monoalcohols such as methanol are effective in decreasing the color of the resulting polyamines and/or polyisocyanates.

It is respectfully submitted that the Adkins et al reference does not disclose or suggest any information to one of ordinary skill in the art which would lead one to conclude or believe that monoalcohols could or would decrease the color content of the polyamines and/or polyisocyanates. In fact, the working examples of this reference lead the skilled artisan to the opposite conclusion.

Examples 1 and 2 specifically state that a methanol quench was added to the reaction solution after the reducing agent was added. See column 2, lines 59-65 and column 3, lines 28-34. The resulting polyamines were then phosgenated to form the corresponding polyisocyanates. The color of the resultant PMDI's at 430 nm and 520 nm absorption were measured and compared to PMDI's prepared in the same manner with no reducing agent. These results are reported at column 3, lines 11-16 and at column 3, lines 45-50. Example 1 and Example 2 were again repeated, except a methanol quench was not used (column 3, lines 17-18 and column 3, lines 51-52). These absorptions at 430 nm and 520 nm were then compared to those for PMDI's prepared with no reducing agent (column 3, lines 18-21 and column 3, lines 52-55). These results are reported at column 3, lines 21-23 and at column 3, lines 55-57.

In both Examples 1 and 2, the results with **no** methanol quench yielded the highest (i.e. greatest percent) reduction in absorption at 430 nm and 520

nm. More specifically, the PMDI in Example 1 prepared with the reducing agent but no methanol quench gave a 79% decrease in color at 430 nm and a 91% decrease in color at 520 nm vs. the standard. (See column 3, lines 17-23.) These are both higher than the percent decrease in color when a reducing agent and methanol quench are used in the preparation of PMDI. The combination of a reducing agent and methanol quench gave a 75% decrease in color at 430 nm and an 86% decrease in color at 520 nm vs. the standard. (See column 3, lines 11-16.) The standard is conventional PMDI which is prepared without a reducing agent or a methanol quench. In Example 2, the PMDI prepared with the reducing agent but no methanol quench gave an 86% decrease in color at 430 nm and a 92% decrease in color at 520 nm vs. the standard. (See column 3, lines 51-57.) These are both higher than the percent decrease in color when a reducing agent and methanol quench are used in the preparation of PMDI. This combination gave an 80% decrease in color at 430 nm and a 90% decrease in color at 520 nm vs. the standard. (See column 3, lines 45-50.)

Applicants respectfully submit that this information leads the skilled artisan to conclude that the reducing agent alone provides the greatest improvement in decreasing the color of the PMDI. In fact, it appears that the methanol quench with the reducing agent results in a slightly lower percentage decrease in color at both 430 nm and 520 nm compared to when the reducing agent alone is used. Thus, the Adkins et al reference simply does **not** lead one of ordinary skill in the art to expect and/or believe that methanol alone (or any other low molecular weight monoalcohol) would be effective in reducing the color of PMDI in the absence of the reducing agents required therein. Such a conclusion is clearly contrary to the results of Examples 1 and 2 when considered in their entirety.

In view of the above, it is respectfully submitted that the presently claimed invention is clearly not anticipated by the Adkins et al reference. Applicants respectfully request that this rejection be withdrawn and the Claims be allowed.

Claims 11 and 17 were rejected under 35 U.S.C. 103(a) as being unpatentable over the WO 99/40059 reference or the Ross et al reference (U.S.

Patent 3,478,099), each in view of the Scherzer et al references (U.S. Patent 6,229,043 or U.S. Patent 5,208,368). Applicants note that Claim 17 has been canceled by the present amendment.

The Scherzer et al reference (U.S. 6,229,043) relates to a process for preparing raw diphenylmethane diisocyanate (MDI) having a decreased iodine color number and a reduced chlorine content. This process comprises reacting the corresponding raw diphenylmethane diamine (MDA) with phosgene in the presence of at least one inert organic solvent at elevated temperature, separating off the excess phosgene and solvent, and thermally treating the reaction product. Specifically, a mixture comprising water and at least one monohydric polyoxyalkylene alcohol, polyhydric polyoxyalkylene alcohol or mixture thereof, is incorporated into the reaction mixture in an effective amount after the phosgenation is completed. This may occur either in the presence of the absence of the phosgene. Thus, this treatment may be either before the excess phosgene and solvent are separated off or after they are separated off. See column 3, lines 15-25.

The Scherzer et al reference (U.S. 5,208,368) is directed to a process for the preparation of crude MDI having a reduced iodine color number. This process comprises reacting the corresponding crude MDI with phosgene in the presence of at least one inert organic solvent at elevated temperature, removing the excess phosgene and solvent when the phosgenation is complete, and heating the reaction product obtained. In addition, once the phosgenation is complete, a monohydric or polyhydric polyoxyalkylene alcohol (or a mixture thereof) having a functionality of 2 to 8 is incorporated into the reaction mixture in an effective amount. See column 2, line 64 through column 3, line 8.

Applicants respectfully submit that combining the WO 99/40059 reference or the Ross et al reference (U.S. Patent 3,478,099), each in view of the Scherzer et al references (U.S. Patent 6,229,043 or U.S. Patent 5,208,368) does not render the presently claimed invention obvious to one of ordinary skill in the art.

As previously discussed above with regard to the anticipation rejections of the presently claimed invention in view of WO 99/40059 reference or the Ross et al reference (U.S. Patent 3,478,099), neither of these references discloses addition of an alcohol after the condensation reaction between the aniline and formaldehyde is completed. In addition, neither of the Scherzer et al references disclose adding a monohydric or polyhydric alcohol prior to the phosgenation of the polyamines.

The present language of Claim 11 clearly requires that an alcohol be added to the process (1) at the beginning of the neutralization step, (2) during the neutralization step, or (3) after the neutralization and before the phase separation, i.e. step c). None of the references presently relied on in this rejection of the claims discloses or suggests adding an alcohol at any of these three points of the process as required by Applicants' claims. Accordingly, there is no basis for altering the process of the primary or secondary reference in the necessary manner to "arrive at" the presently claimed invention.

Applicants respectfully submit that the presently claimed invention is not fairly suggested to one of ordinary skill in the art from this combination of references. The present claim language does not permit the addition of the alcohol component at any time during or after the phase separation. Thus, it is submitted that this rejection is improper and requested that it be withdrawn. The allowance of Claim 11 is respectfully requested.

Claims 11, 17 and 20 were rejected under 35 U.S.C. 103(a) as being unpatentable over the WO 99/40059 reference or the Ross et al reference (U.S. Patent 3,478,099), each in view of the Scherzer et al reference (U.S. Patent 5,207,942) or the Danielmeier et al reference (U.S. Patent 6,395,925). Applicants note that Claim 17 has been cancelled by the present amendment.

The Scherzer et al reference (U.S. 5,207,942) is directed to a process for preparing crude MDI having a reduced iodine color number. This process comprises reacting the crude MDA with phosgene in the presence of one or more inert organic solvents at elevated temperatures, separating off the excess phosgene and solvent after phosgenation is complete and subjecting the

resulting reaction product to a thermal treatment in which a low molecular weight alkanol, or preferably a polyhydric alcohol or a mixture of a low molecular weight alkanol and a low molecular weight polyhydric alcohol is incorporated into the reaction mixture after the phosgenation is completed. See column 3, lines 7-19.

A process for the purification of an organic isocyanate and the purified organic isocyanate are disclosed in the Danielmeier et al reference (U.S. 6,395,925). This process comprises adding a small quantity of at least one compound corresponding to the formula as set forth at column 3, lines 1-18 to the organic isocyanate to be purified. The isocyanate containing this compound is then heated for a certain time (possibly under elevated or reduced pressure) and either simultaneously or subsequently, the isocyanate being treated is stripped with an inert gas and/or is purified by a single distillation and/or extraction procedure.

As previously discussed, neither the Strofer et al (WO 99/40059) reference or the Ross et al reference disclose or suggest that the alcohol component be added (1) at the beginning of the neutralization of the reaction mixture, (2) during the neutralization of the reaction mixture, or (3) after the neutralization of the reaction mixture and before the phase separation of the neutralized reaction mixture as required by the express language of Claim 11. Rather, the so-called alcohol in these references is actually part of the formaldehyde reactant used in the condensation reaction with aniline to form polyamines. This is discussed in depth above with regard to the anticipation rejection based on each of these references.

The Scherzer et al reference ('942) only discloses that an alcohol (or low molecular weight alkanol) can be added to the process after the phosgenation of the polyamines to the corresponding polyisocyanates is complete. The present invention does not add alcohol to the process after the completion of the phosgenation step. Furthermore, combining this reference with either the Strofer et al reference or the Ross et al reference does not result in the presently claimed invention! One of ordinary skill in the art has no insight into the present invention upon reading either the Strofer et al reference or the Ross et al

reference in view of the Scherzer et al reference ('942). It is respectfully submitted that the present invention is not fairly suggested to the skilled artisan from either of these combinations of references.

In addition, the Danielmeier et al reference described purification of an isocyanate component by combining the isocyanate with an additive of a specific formula as set forth at column 3, lines 1-17. This additive may contain a hydroxyl group or a thiol group. This additive is, however, clearly added to the formed isocyanate component. Applicants respectfully submit that the present claim language does not permit the addition of the alcohol component at any time after the phase separation.

Rather, the alcohol is added to the reaction mixture formed by the condensation of aniline and formaldehyde (1) at the beginning of the neutralization, (2) during the neutralization or (3) after neutralization and before phase separation. It is readily apparent that the present invention requires the alcohol addition at a different point than what is disclosed and/or suggested by the Danielmeier et al reference.

Applicants respectfully submit that none of the presently cited references discloses or suggests adding the alcohol to the reaction mixture at the point required by the present claim language. It is therefore "obvious" that any of these combinations of references does not fairly suggest the presently claimed invention to one of ordinary skill in the art. Accordingly, Applicants respectfully submit that this rejection is improper and request that it be withdrawn.

In view of the above amendments and remarks, Applicants respectfully submit that each of these rejections is in error and request that they be withdrawn. The allowance of Claims 1, 8-11, and 18-24 is respectfully requested.

Respectfully submitted,

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